

Space data and information transfer systems — Telecommand — Data routing service

ICS 49.140

National foreword

This British Standard reproduces verbatim ISO 12172:2003 and implements it as the UK national standard. It supersedes BS Z 15:1998 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee ACE/68, Space systems and operations, to Subcommittee ACE/68/-/7, Space data and information transfer systems, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

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Summary of pages

This document comprises a front cover, an inside front cover, the ISO title page, pages ii and iii, a blank page, pages 1 to 61 and a back cover.

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INTERNATIONAL STANDARD

ISO 12172

Second edition
2003-02-15

Space data and information transfer systems — Telecommand — Data routing service

*Systèmes de transfert des informations et données spatiales —
Télécommande — Service d'acheminement des données*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 12172 was prepared by the Consultative Committee for Space Data Systems (CCSDS) (as CCSDS 202.0-B-3, June 2001) and was adopted (without modifications except those stated in Clause 2 of this International Standard) by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 13, *Space data and information transfer systems*.

This second edition cancels and replaces the first edition (ISO 12172:1998), which has been technically revised.

Space data and information transfer systems — Telecommand — Data routing service

1 Scope

This International Standard specifies the common requirements which define the data routing service of a spacecraft telecommand. The intent of this document is to provide a common framework within which space agencies may implement compatible future spacecraft telecommanding systems.

The scope and field of application are furthermore detailed in subclauses 1.1 and 1.2 of the enclosed CCSDS publication.

2 Requirements

Requirements are the technical recommendations made in the following publication (reproduced on the following pages), which is adopted as an International Standard:

CCSDS 202.0-B-3, June 2001, *Recommendation for space data system standards — Telecommand — Part 2: Data routing service*.

For the purposes of international standardization, the modifications outlined below shall apply to the specific clauses and paragraphs of publication CCSDS 202.0-B-3.

Pages i to v

This part is information which is relevant to the CCSDS publication only.

Pages 1-2 to 1-3

Add the following information to the references indicated in subclause 1.4:

- [1] Document CCSDS 203.0-B-2, June 2001, is equivalent to ISO 12174:2003.
- [2] Document CCSDS 201.0-B-3, June 2000, is equivalent to ISO 12171:2002.
- [3] Document CCSDS 102.0-B-5, November 2000, is equivalent to ISO 13419:2003.
- [4] Document CCSDS 202.1-B-2, June 2001, is equivalent to ISO 12173:2003
- [5] Document CCSDS 713.0-B-1, May 1999, is equivalent to ISO 15891:2000.
- [6] Document CCSDS 714.0-B-1, May 1999, is equivalent to ISO 15893:2000.
- [7] Document CCSDS 717.0-B-1, May 1999, is equivalent to ISO 15894:2000.
- [9] Document CCSDS 701.0-B-3, June 2001, is equivalent to ISO 13420:—¹⁾.

1) To be published. (Revision of ISO 13420:1997)

Add the following information to the reference indicated:

[C3] Document CCSDS 101.0-B-5, June 2001, is equivalent to ISO 11754:2003.

3 Revision of publication CCSDS 202.0-B-3

It has been agreed with the Consultative Committee for Space Data Systems that Subcommittee ISO/TC 20/SC 13 will be consulted in the event of any revision or amendment of publication CCSDS 202.0-B-3. To this end, NASA will act as a liaison body between CCSDS and ISO.

Consultative Committee for Space Data Systems

RECOMMENDATION FOR SPACE
DATA SYSTEM STANDARDS

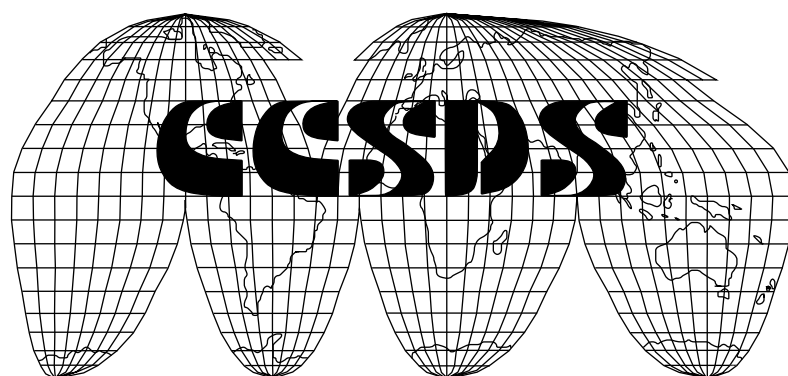
TELECOMMAND

PART 2
DATA ROUTING SERVICE

CCSDS 202.0-B-3

BLUE BOOK

June 2001



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CCSDS RECOMMENDATION FOR TELECOMMAND: DATA ROUTING SERVICE

AUTHORITY

Issue:	Blue Book, Issue 3
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Location:	Oxfordshire, UK

This document has been approved for publication by the Management Council of the Consultative Committee for Space Data Systems (CCSDS) and represents the consensus technical agreement of the participating CCSDS Member Agencies. The procedure for review and authorization of CCSDS Recommendations is detailed in the Reference [C1], and the record of Agency participation in the authorization of this document can be obtained from the CCSDS Secretariat at the address below.

This Recommendation is published and maintained by:

CCSDS Secretariat
Program Integration Division (Code MT)
National Aeronautics and Space Administration
Washington, DC 20546, USA

CCSDS RECOMMENDATION FOR TELECOMMAND: DATA ROUTING SERVICE

STATEMENT OF INTENT

The Consultative Committee for Space Data Systems (CCSDS) is an organization officially established by the management of member space Agencies. The Committee meets periodically to address data systems problems that are common to all participants, and to formulate sound technical solutions to these problems. Inasmuch as participation in the CCSDS is completely voluntary, the results of Committee actions are termed **RECOMMENDATIONS** and are not considered binding on any Agency.

This RECOMMENDATION is issued by, and represents the consensus of, the CCSDS Plenary body. Agency endorsement of this RECOMMENDATION is entirely voluntary. Endorsement, however, indicates the following understandings:

- o Whenever an Agency establishes a CCSDS-related STANDARD, this STANDARD will be in accord with the relevant RECOMMENDATION. Establishing such a STANDARD does not preclude other provisions which an Agency may develop.
- o Whenever an Agency establishes a CCSDS-related STANDARD, the Agency will provide other CCSDS member Agencies with the following information:
 - The STANDARD itself.
 - The anticipated date of initial operational capability.
 - The anticipated duration of operational service.
- o Specific service arrangements shall be made via memoranda of agreement. Neither this RECOMMENDATION nor any ensuing STANDARD is a substitute for a memorandum of agreement.

No later than five years from its date of issuance, this Recommendation will be reviewed by the CCSDS to determine whether it should: (1) remain in effect without change; (2) be changed to reflect the impact of new technologies, new requirements, or new directions; or (3) be retired or canceled

In those instances when a new version of a RECOMMENDATION is issued, existing CCSDS-related Agency standards and implementations are not negated or deemed to be non-CCSDS compatible. It is the responsibility of each Agency to determine when such standards or implementations are to be modified. Each Agency is, however, strongly encouraged to direct planning for its new standards and implementations towards the later version of the Recommendation.

CCSDS RECOMMENDATION FOR TELECOMMAND: DATA ROUTING SERVICE

FOREWORD

This document, which is a technical Recommendation prepared by the Consultative Committee for Space Data Systems (CCSDS), is intended for use by participating space Agencies in their development of space telecommand systems.

This Recommendation allows the implementing organizations within each Agency to proceed coherently with the development of compatible Standards for the flight and ground systems that are within their cognizance. Agency Standards derived from this Recommendation may implement only a subset of the optional features allowed herein, or may incorporate features not addressed by the Recommendation.

In order to establish a common framework within which the Agencies may develop standardized telecommand services, the CCSDS advocates adoption of a layered systems architecture. Within this approach, specific layers of service (including their operational protocol and data structuring techniques) may be selected for implementation according to mission requirements.

The current layered set of CCSDS telecommand Recommendations was developed to match the conventional free-flying mission environment, as characterized by the transmission of command data at relatively low uplink data rates to spacecraft of moderate complexity. Advanced Orbiting Systems (AOS), which are characterized by a more complex mission environment, including the transmission of multiple data types at very high data rates to space vehicles which include extensive onboard data networking capability, may choose to use the AOS protocols and data structures defined in Reference [9] for both uplink and downlink or they may use the telecommand data structures and protocols defined here for uplink.

This Recommendation for Telecommand Data Routing Service was developed within the layered architectural framework, and embraces the standard data structures and data communication procedures which may be used by conventional missions within the intermediate telecommand system layers.

Through the process of normal evolution, it is expected that expansion, deletion or modification to this document may occur. This Recommendation is therefore subject to CCSDS document management and change control procedures defined in Reference [C1]. Current versions of CCSDS documents are maintained at the CCSDS Web site:

<http://www.ccsds.org/>

Questions relating to the contents or status of this Report should be addressed to the CCSDS Secretariat at the address on page i.

CCSDS RECOMMENDATION FOR TELECOMMAND: DATA ROUTING SERVICE

At time of publication, the active Member and Observer Agencies of the CCSDS were:

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- Agenzia Spaziale Italiana (ASI)/Italy.
- British National Space Centre (BNSC)/United Kingdom.
- Canadian Space Agency (CSA)/Canada.
- Centre National d'Etudes Spatiales (CNES)/France.
- Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)/Germany.
- European Space Agency (ESA)/Europe.
- Instituto Nacional de Pesquisas Espaciais (INPE)/Brazil.
- National Aeronautics and Space Administration (NASA)/USA.
- National Space Development Agency of Japan (NASDA)/Japan.
- Russian Space Agency (RSA)/Russian Federation.

Observer Agencies

- Austrian Space Agency (ASA)/Austria.
- Central Research Institute of Machine Building (TsNIIMash)/Russian Federation.
- Centro Tecnico Aeroespacial (CTA)/Brazil.
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- European Telecommunications Satellite Organization (EUTELSAT)/Europe.
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- National Space Program Office (NSPO)/Taipei.
- Swedish Space Corporation (SSC)/Sweden.
- United States Geological Survey (USGS)/USA.

CCSDS RECOMMENDATION FOR TELECOMMAND: DATA ROUTING SERVICE

DOCUMENT CONTROL

Document	Title	Date	Status and Substantive Changes
CCSDS 202.0-B-1	Recommendation for Space Data System Standards. Telecommand, Part 2 Data Routing Service, Issue 1	January 1987	Original Issue
CCSDS 202.0-B-2	Recommendation for Space Data System Standards Telecommand, Part 2 Data Routing Service, Issue 2	November 1992	Superseded
CCSDS 202.0-B-3	Recommendation for Space Data System Standards Telecommand, Part 2 Data Routing Service, Issue 3	June 2001	Current Issue: modifies terminology to clarify that the TC Transfer Frame can be used to transport various types of packets, including TC Packets, CCSDS Network Protocol (NP) datagrams, and Internet Protocol (IP) datagrams.
NOTE:	Substantive changes from the previous issue are flagged with change bars in the inside margin.		

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CCSDS RECOMMENDATION FOR TELECOMMAND: DATA ROUTING SERVICE

1 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this document is to establish a common Recommendation for the implementation of a spacecraft telecommand “Data Routing Service” by the Agencies participating in the Consultative Committee for Space Data Systems (CCSDS). The operating principles and procedures for the CCSDS are defined in Reference [C1]. The context of the Data Routing Service within the overall Telecommand System is described in Reference [C2].

This Recommendation addresses the procedures and data unit formats implemented within the Segmentation layer and the Transfer layer of the telecommand Data Routing Service.

1.2 APPLICABILITY

This Recommendation serves as a guideline for the development of compatible internal Agency standards in the field of conventional spacecraft commanding. This Recommendation is not retroactive, nor does it commit any Agency to implement the recommended telecommand concepts at any future time. Nevertheless, all CCSDS Agencies accept the principle that all future implementations of telecommand which are used in cross-support situations will be based on this Recommendation.

The CCSDS has developed a layered concept for conventional spacecraft telecommanding, which is summarized in Reference [C2]. Standard services are defined within each layer, and Agencies will be encouraged to develop corresponding facilities to provide these services in support of Projects.

To be fully compatible with the CCSDS concept, a conventional Project’s telecommanding architecture should follow this Recommendation for Data Routing Service, plus the Recommendations for telecommand “Data Management Service” and telecommand “Channel Service”, which are described in References [1] and [2]. Projects may also elect to be partially compatible with the concept by interfacing with the standard systems at intermediate layers within any of the service specifications.

Missions may use the telecommand data structures and protocols defined here and in References [1], [2], and [4], or they may utilize data structures and protocols defined in references [5], [6], and [7] for uplinking data and control information.

Where preferred options or mandatory capabilities are clearly indicated herein, the indicated sections of the specification must be implemented when this Recommendation is used as a basis for cross-support. Where optional subsets or capabilities are allowed or implied in this specification, implementation of these options or subsets is subject to specific bilateral cross-support agreements between the Agencies involved.

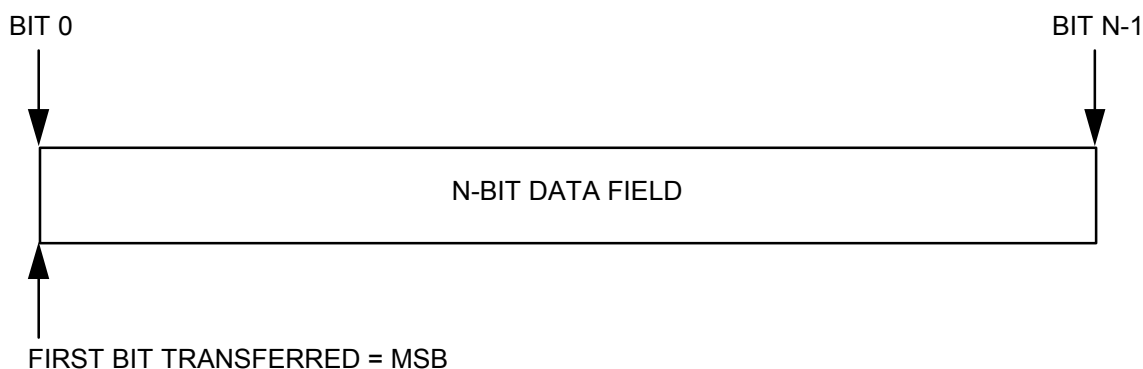
CCSDS RECOMMENDATION FOR TELECOMMAND: DATA ROUTING SERVICE

The recommendations in this document are to be invoked through the normal standards programs of each member Agency, and are applicable to those missions for which cross-support based on capabilities described in these recommendations is anticipated.

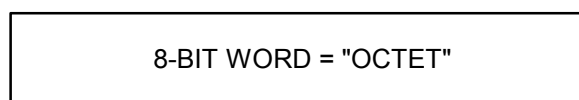
1.3 BIT NUMBERING CONVENTION AND NOMENCLATURE

In this document, the following convention is used to identify each bit in an N-bit field:

The first bit in the field to be transferred (i.e., the most left justified when drawing a figure) is defined to be “Bit 0”; the following bit is defined to be “Bit 1” and so on up to “Bit N-1”. When the field is used to express a binary value (such as a counter), the Most Significant Bit (MSB) shall be the first bit of the field, i.e., “Bit 0”.



In accordance with modern data communications practice, spacecraft data fields are often grouped into 8-bit “words” which conform to the above convention. Throughout this Recommendation, the following nomenclature is used to describe this grouping:



By CCSDS convention, all “spare” bits shall be permanently set to value “zero”.

Note that throughout this document, the word “Telecommand” may be abbreviated as “TC”.

1.4 REFERENCES

- [1] *Telecommand Part 3—Data Management Service*. Recommendation for Space Data System Standards, CCSDS 203.0-B-2. Blue Book. Issue 2. Washington, D.C.: CCSDS, June 2001.

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- [2] *Telecommand Part 1—Channel Service*. Recommendation for Space Data System Standards, CCSDS 201.0-B-3. Blue Book. Issue 3. Washington, D.C.: CCSDS, June 2000.
- [3] *Packet Telemetry*. Recommendation for Space Data System Standards, CCSDS 102.0-B-5. Blue Book. Issue 5. Washington, D.C.: CCSDS, November 2000.
- [4] *Telecommand Part 2.1—Command Operation Procedures*. Recommendation for Space Data System Standards, CCSDS 202.1-B-2. Blue Book. Issue 2. Washington, D.C.: CCSDS, June 2001.
- [5] *Space Communications Protocol Specification (SCPS)—Network Protocol (SCPS-NP)*. Recommendation for Space Data System Standards, CCSDS 713.0-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, May 1999.
- [6] *Space Communications Protocol Specification (SCPS)—Transport Protocol (SCPS-TP)*. Recommendation for Space Data System Standards, CCSDS 714.0-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, May 1999.
- [7] *Space Communications Protocol Specification (SCPS)—File Protocol (SCPS-FP)*. Recommendation for Space Data System Standards, CCSDS 717.0-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, May 1999.
- [8] *CCSDS Global Spacecraft Identification Field Code Assignment Control Procedures*. Recommendation for Space Data System Standards, CCSDS 320.0-B-2. Blue Book. Issue 2. Washington, D.C.: CCSDS, October 1998.
- [9] *Advanced Orbiting Systems, Networks and Data Links: Architectural Specification*. Recommendation for Space Data System Standards, CCSDS 701.0-B-3. Blue Book. Issue 3. Washington, D.C.: CCSDS, June 2001.

The latest issues of CCSDS documents may be obtained from the CCSDS Secretariat at the address indicated on page i.